

CONTRACT FOR CHEMICAL PROCESSING AND FABRICATION SERVICES
BETWEEN THE
UNITED STATES ATOMIC ENERGY COMMISSION
ACTING FOR AND ON BEHALF OF THE
GOVERNMENT OF THE UNITED STATES OF AMERICA
AND
THE NATIONAL COMMITTEE FOR NUCLEAR ENERGY
ACTING FOR AND ON BEHALF OF THE GOVERNMENT OF
THE ITALIAN REPUBLIC

This Contract entered into this 17th day of November, 19 65,
by and between THE UNITED STATES ATOMIC ENERGY COMMISSION (hereinafter
referred to as the "Commission") acting for and on behalf of THE GOVERNMENT
OF THE UNITED STATES OF AMERICA (hereinafter sometimes referred to as the
"Government", or "United States Government"), and THE NATIONAL COMMITTEE FOR
NUCLEAR ENERGY (hereinafter referred to as "CNEN") acting for and on behalf
of the Government of the Italian Republic.

WITNESSETH THAT:

WHEREAS, the Commission and the CNEN have a common interest in obtaining
a deeper assessment of the thorium-uranium fuel cycle and recognize the advantages
of cooperation in specific programs for that purpose and;

WHEREAS, the CNEN as part of its interest in this field is currently
building a limited decontamination pilot plant (hereinafter called "PCUT")
for chemically processing thorium-uranium fuel elements and remotely fabricating
the recovered source and special nuclear material mixtures into new
fuel elements; and

WHEREAS, the Commission in connection with its Power Demonstration
Reactor Program owns and is operating through one of its prime contractors
a nuclear reactor plant at Elk River, Minnesota, and such reactor utilizes
thorium-uranium fuel elements; and

WHEREAS, the Commission and the CNEN intend to share freely in the technical data developed under this Contract and to exchange personnel on a mutually agreeable basis during the term of this Contract for the purpose of observing activities at the PCUT and the Elk River Reactor; and

WHEREAS, the Commission and the CNEN on November 14, 1962, signed a Memorandum of Understanding embodying the principles of a chemical processing and refabrication arrangement for the Elk River fuel elements; and

WHEREAS, the CNEN desires to perform the chemical processing and refabrication of the first core loading of fuel assemblies from the Elk River reactor upon the terms, conditions and provisions hereafter set forth, and the Commission desires to enter into the arrangement.

WHEREAS, it is the hope and intent of the Commission and the CNEN that the refabricated fuel assemblies will be suitable for insertion and irradiation in the Elk River Reactor; and

WHEREAS, this Contract is executed under the authority of the United States Atomic Energy Act of 1954, as amended, and pursuant to the Agreement for Cooperation between the United States and the Republic of Italy signed at Washington on July 3, 1957, as amended, and the Additional Agreement for Cooperation between the Government of the United States of America and the European Atomic Energy Community, as amended, signed June 11, 1960.

NOW THEREFORE THE PARTIES HERETO MUTUALLY AGREE AS FOLLOWS:

ARTICLE I - DEFINITIONS

The following terms, as used herein, shall have the following meanings:

A. "Chemical Processing". The chemical processing of Elk River reactor fuel assemblies for the purpose of separating and recovering the recoverable source and special nuclear material contained therein.

B. "Fabrication". The fabrication of fuel assemblies in compliance with the outline specification and requirements set forth in Appendix A to this Contract.

C. "Commission". The United States Atomic Energy Commission or any duly authorized representative thereof.

D. "ERR Fuel Assemblies". Irradiated fuel assemblies from the first core loading of the Elk River reactor.

E. "First Core Loading". One hundred and forty-eight fuel assemblies comprising the initial core of the Elk River reactor.

F. "RERR Fuel Assemblies". Remotely fabricated fuel assemblies containing source and special nuclear materials recovered from the chemical processing operation blended with supplemental quantities of source and special nuclear materials as required to satisfy the thorium uranium proportions and the uranium isotopic ratio specified by the Commission in writing prior to time of fabrication.

G. "Reactor". The nuclear reactor owned by the Commission at Elk River, Minnesota, U.S.A., designated as the Elk River reactor.

H. "Source Material". Uranium, thorium, or any other material which is determined by the Commission pursuant to the Atomic Energy Act of 1954, as amended, to be source material.

I. "Special Nuclear Material". (1) Plutonium, uranium 233, uranium enriched in the isotope 233 or in the isotope 235, and any other material which the Commission, pursuant to the provisions of the Atomic Energy Act of 1954, as amended, determines to be special nuclear material, but does not include source material; or (2) any material artificially enriched by any of the foregoing, but does not include source material.

ARTICLE II - SCOPE

This Contract provides for the chemical processing of ERR fuel assemblies to be discharged from the Elk River reactor, the fabrication of recovered material into RERR or other type fuel assemblies, or, alternatively, return of recovered material in non-refabricated form, and the concurrent development of data on thorium-uranium fuel under the following program outline:

A. Shipment to the PCUT, as hereinafter provided, of up to a full core loading of ERR fuel assemblies.

B. Chemical processing by CNEN of up to a full core loading of ERR fuel assemblies.

C. Fabrication by CNEN of RERR or other type fuel assemblies in compliance with the outline specification and requirements contained in Appendix A to this Contract. Except as otherwise provided in ARTICLE II bis,

infra, the number of RERR or other type fuel assemblies fabricated and delivered under this Contract shall equal the number of ERR fuel assemblies delivered for chemical processing.

D. Observation by persons designated by the Commission of the chemical processing and fabrication program described in subparagraphs B and C of this Article and by employees of CNEN of the related operational activities at the Elk River reactor.

E. Development and mutual exchange of information and data concerning the chemical processing and fabrication work contemplated hereunder and the related operational activities at the Elk River reactor.

F. Delivery by CNEN to the Commission, as hereinafter provided, of the RERR or other type fuel assemblies, or recovered material in non-refabricated form.

ARTICLE II bis

The Commission and the CNEN recognize that since the signing on November 14, 1962, of their Memorandum of Understanding, delays have occurred in the construction of the PCUT and that the Commission's loading requirements for the reactor are such that under the CNEN's current schedule for production operation of the PCUT only the initially discharged one-third core loading of ERR fuel assemblies can be refabricated on a timely basis for possible re-irradiation in the reactor within the present operating period. The Commission, therefore, notwithstanding any other provision of this Contract, shall have an option to receive source and

special nuclear material recovered from either or both of the second and third lots of ERR fuel assemblies in the form of RERR fuel assemblies or, in lieu of RERR fuel assemblies, in such non-refabricated form as the Commission may request, unless the parties mutually agree on other type fuel assemblies and the adjustment in price therefor. In the event the Commission elects to receive recovered material from either or both the second and third lots of ERR fuel assemblies in a non-refabricated form, it shall signify its election by notice in writing to the CNEN prior to delivery of an affected lot of ERR fuel assemblies or at such later date as may be mutually agreed in writing. The price payable under Article XII of the Contract shall be appropriately adjusted downward to a lesser amount in accordance with the computation provided for in Article XIII B with respect to any material recovered from ERR fuel assemblies which is returned in a non-refabricated form.

ARTICLE III - TECHNICAL LIAISON PERSONNEL

A. Unless the CNEN otherwise notifies the Commission the CNEN's representative for technical matters under this Contract shall be designated by the Director of the PCUT Service.

B. Unless the Commission otherwise notifies the CNEN the Commission's representative for technical matters under this Contract shall be designated by the Director, Division of Reactor Development and Technology.

C. The individuals whose names appear above have been designated by the parties as their respective liaison representatives for all technical matters under this Contract. In the event either party replaces its

technical representative it shall promptly notify the other party in writing of its designated successor representative.

ARTICLE IV - MATERIAL LEASE

Special nuclear material required for performance of this Contract including special nuclear material contained in the ERR fuel assemblies and up to 31 kilograms of uranium enriched to approximately 93% in the isotope U-235, will be transferred under the terms and conditions of a special nuclear material lease agreement between the Commission and the European Atomic Energy Community, pursuant to the Additional Agreement for Cooperation, as amended, between the United States of America and the European Atomic Energy Community signed on June 11, 1960. The terms and conditions relating to responsibility and accountability for the leased material shall insofar as the Commission is concerned, be established in the aforesaid lease agreement, it being understood that EURATOM will make such leased material available to CNEN for the Contract purposes pursuant to arrangements established between them.

ARTICLE V - DELIVERY OF ERR FUEL ASSEMBLIES

A. The Commission will deliver the ERR fuel assemblies to the European Atomic Energy Community in three lots, each lot approximately equivalent to one-third of the initial full core loading for the reactor, in accordance with a delivery schedule set forth in the lease agreement referred to in Article IV.

B. The CNEN agrees that the Commission may withhold a reasonable number of ERR fuel assemblies for post irradiation examination. Defective ERR fuel assemblies will be withheld from shipment unless otherwise mutually agreed.

ARTICLE VI - STATEMENT OF WORK AND SERVICES

CNEN shall, upon the terms, conditions and provisions herein set forth, and in compliance with the final specification and requirements referred to in subparagraph 3 hereunder, for the consideration stated in Articles XII and XIII, furnish all personnel, labor, materials, equipment and services to do all things necessary to perform the services and carry out the obligations required of CNEN under this Contract. In connection with the chemical processing and fabrication services to be provided under this Contract, but not in limitation thereof, CNEN shall:

1. Determine in accordance with the requirements of the lease agreement referred to in Article IV the amount of source and special nuclear materials in each lot of ERR fuel assemblies.

2. Except as provided in Article II bis supra, reconstitute the source and special nuclear material recovered from each lot of ERR fuel assemblies and blend the recovered source and special nuclear materials with supplemental quantities of source and special nuclear materials as required to satisfy the fuel material proportions to be specified by the Commission for the RERR fuel assemblies. Supplemental quantities of

special nuclear material shall be made available by the Commission in accordance with the lease agreement referred to in Article IV.

3. Except as provided in Article II bis, supra, fabricate RERR fuel assemblies containing the reconstituted and blended source and special nuclear materials referred to in subparagraph 2 above in compliance with the outlined specification and requirements contained in Appendix A to this Contract. Final specifications of the RERR fuel assemblies including fabrication drawings will be prepared in the English language by CNEN in accordance with instructions from the Commission or persons acting on behalf of the Commission. CNEN shall furnish ten complete sets of detailed RERR fuel assembly specifications including fabrication drawings for approval by the Commission prior to initiating procurement or fabrication of any components for the RERR fuel assemblies. It is specifically understood and agreed that fuel material proportions and final design of the RERR fuel assemblies are subject to change by the Commission as experience is gained with the operation of the reactor with such changes to be effected by CNEN without affecting the price set forth in Article XII if requested prior to final approval by the Commission of such proportions and design provided, however, that if the Commission directs that the cladding of the RERR fuel assemblies be changed from stainless steel to Zircalloy, the per lot price set forth in paragraph A of Article XII shall be increased by \$26,670.

ARTICLE VII - DELIVERY AND ACCEPTANCE OF RERR FUEL ASSEMBLIES

In accordance with a mutually agreed schedule [based upon core loading requirements for the reactor] and subject to the lease agreement referred to in Article IV, CNEN shall deliver the RERR fuel assemblies, or alternate form of recovered material specified by the Commission under either Articles II bis or XIII, [in three lots] to a facility or location in the United States designated by the Commission. [Each lot of RERR fuel assemblies to be delivered under this contract shall be equivalent in number to the corresponding lot of ERR fuel assemblies delivered by the Commission under Article V. Inspection for compliance with the final specifications for the RERR fuel assemblies will be made jointly by CNEN and the Commission at the PCUT prior to loading in shipping containers for delivery pursuant to this Article. Acceptance of the RERR fuel assemblies will take place as soon as practicable after arrival of the RERR fuel assemblies at the designated place of delivery in the United States. CNEN shall be notified, through its technical representative, when acceptance is anticipated to occur and may if it so desires have a representative present to observe at the time and place of Commission inspection for acceptance purposes. The Commission retains the right to reject any RERR fuel assembly which is found to be damaged, and to require the CNEN to return damaged RERR fuel assemblies, at CNEN expense, to the PCUT facility or other facility as may be agreed for reworking in accordance with the Commission's final specifications and requirements. All necessary arrangements for transportation of damaged RERR fuel assemblies within the United States to the port of embarkation shall be made by the Commission at CNEN's expense.]

ARTICLE VIII - TRANSPORTATION COSTS AND ARRANGEMENTS

A. Shipping Containers. The ERR and RERR fuel assemblies, or any alternate form of the recovered material specified by the Commission under either Articles II bis or XIII will be transported in shipping containers provided by the Commission at no cost to the CNEN. Any shipping container which the Commission determines to be not required for redelivery purposes under this Contract will be promptly returned by the CNEN, at CNEN expense, to a facility or location in the United States designated by the Commission. After removal of the ERR fuel assemblies at the PCUT facility, all shipping containers provided for purposes of this Contract will be decontaminated by CNEN at CNEN expense and in connection with their return shipment to the Commission shall meet all pertinent regulations and standards of the International Atomic Energy Agency.

B. Shipment of ERR fuel assemblies. The Commission shall bear all costs incident to delivery of the ERR fuel assemblies, F.A.S. vessel at an East Coast port of shipment in the United States designated by the Commission and make the necessary arrangements therefor. CNEN shall bear all costs and make the necessary arrangements for transportation of the ERR fuel assemblies thereafter to the PCUT.

C. Shipment of RERR fuel assemblies. CNEN shall bear all costs, up to and including off loading of shipping containers, incident to transportation of [the RERR fuel assemblies or alternate form of] recovered material to a Commission-designated East Coast port of import in the United States. CNEN shall also make the necessary arrangements for

transportation and insurance of the RERR fuel assemblies to a facility or location in the United States designated by the Commission. Transportation and insurance costs incident to transfer from the port of import to the specified facility or location shall be borne by the Commission.

D. Port Clearances and Customs Duties. The Commission shall make all necessary arrangements for authorizing the export from the United States of the ERR fuel assemblies and the import into the United States of [the RERR fuel assemblies or alternate form of] recovered material. Any customs duties levied upon import of the RERR fuel assemblies or alternate form of recovered material into the United States shall be borne by the Commission.

ARTICLE IX - OBSERVATION OF COMMISSION AND CNEN DESIGNEES

During the term of this Contract the Commission may assign persons employed by the Commission or its Contractors to be stationed at the PCUT for technical participation in the chemical processing [and fabrication] work. CNEN will accord such Commission-designated persons full opportunity to observe all plant operations connected with the chemical processing and fabrication work including provision of appropriate working space for such persons. All other costs and expenses for participation of Commission designees shall be borne by the Commission. In addition to the persons whom the Commission may station at the PCUT, the Commission may also designate other individuals who will be permitted by CNEN to visit the PCUT to observe and participate in selected phases of the chemical processing [and fabrication] operations. CNEN may also

designate certain of its employees, at CNEN expense, and subject to Commission approval to observe related operational activities at the Elk River reactor.

ARTICLE X - REPORTS

CNEN shall furnish to the Commission detailed monthly reports, in the English language, on its activities under this Contract in such form and content as may be requested by the Commission. Such reports shall include but not be limited to the following:

1. Reports on the construction, completion and testing status of the PCUT;
2. Status reports on the chemical processing [and fabrication] operations;
3. Reports detailing the experience on chemical processing of the ERR fuel assemblies [and the assembly operations for the RERR fuel assemblies including a complete fabrication history, component and fuel inspection reports, component quality control reports, component material certifications and other pertinent documentation;] and
4. Cost accounting reports on the construction, chemical processing and [fabrication] operations.

All such information shall be made available freely to the Commission and without any limitation of the Commission's right to publish or otherwise use the information furnished or to make such information available to others. In turn the Commission shall furnish to CNEN periodic reports

containing information on the operation of the reactor with special regard to information necessary for evaluation of the fuel cycle. The parties shall not publish the information obtained or make such information available to others without mentioning its source. The parties will collaborate on the form content and frequency of such reports.

ARTICLE XI - IRRADIATION TESTING OF RERR FUEL ASSEMBLIES

The Commission desires and expects to test irradiate the RERR fuel assemblies to the fullest extent consistent with its existing contractual commitments and program objectives; provided, however, that the Commission shall not be obligated to irradiate all or any of the RERR fuel assemblies. All information from any such irradiation tests will be made available to the CNEN.

ARTICLE XII - CONSIDERATION

A. In consideration of CNEN's performance of all work and services in accordance with the requirements of this Contract, the Commission will pay to the CNEN either (1) a fixed price of \$365,000 for each lot of RERR fuel assemblies accepted by the Commission, or (2) a negotiated price, as provided in Article XIII b, for each batch of recovered material returned in form other than RERR fuel assemblies.

B. Subject to the provisions of this Contract, payment shall be made in three installments. The first such installment shall become due and payable upon completion of the chemical processing, fabrication,

delivery to and acceptance by the Commission of the first lot of RERR fuel assemblies. The second installment shall become due and payable upon completion of CNEN's work and services, delivery to and acceptance by the Commission of the second lot of RERR fuel assemblies or alternate form of recovered material; the final installment shall become due and payable upon completion of the CNEN's work and service, delivery to and acceptance by the Commission of the third lot of RERR fuel assemblies or alternate form of recovered material and the submission of any reports required under Article X.

ARTICLE XIII - COMMISSION OPTIONS - PRICE ADJUSTMENTS FOR RECOVERED MATERIAL RETURNED IN FORM OTHER THAN RERR FUEL ASSEMBLIES.

A. If CNEN fails to fabricate the first lot of RERR fuel assemblies in compliance with the Commission's final specification and requirement, the Commission shall have an option to receive all source and special nuclear material recovered in the chemical processing operation, including source and special nuclear material recovered from the remaining RERR fuel assemblies, as pellets, powder, or such other form as may then be specified by the Commission. For purpose of this option, the Commission shall make the determination as to compliance of the first lot of RERR fuel assemblies with the final specification within thirty (30) days after notification by CNEN of completion of the fabrication operations for the first third of the RERR fuel assemblies.

B. In the event the Commission exercises its option under the foregoing provision or its right of election under Article II bis supra to

receive the material in non-fabricated form or in the event this Contract is terminated pursuant to Article XVII, the price payable with respect to an affected lot of recovered material shall be negotiated by the parties. In such negotiations the parties will take due account of the fact that a maximum price of \$365,000 has been agreed upon for an accepted lot of RERR fuel assemblies. The negotiated price will be computed from that part of \$365,000 which the Parties may mutually agree to be attributable to the delivered form of the recovered material. For the purpose of this computation the price of \$365,000 per lot, and the maximum total price of \$1,095,000, payable to CNEN under the Contract, not including the possible additional compensation provided for in paragraph 3 of Article VI, represent the agreed estimate of CNEN's operating costs, exclusive of amortization, for performance at the PCUT of all work and services, except transportation services, required under this Contract for completion of three lots of RERR fuel assemblies within a period of two calendar years following delivery to PCUT of the first lot of ERR fuel assemblies; also, for the purpose of this computation \$695,000 of the maximum total price represents compensation for chemical processing under this Contract; \$225,000 of the maximum total price represents compensation for fabrication; and \$175,000 of the maximum total price covers materials use charges and all other costs, except transportation and amortization costs, which CNEN would incur in full performance of this

Contract. Neither party guarantees the accuracy of these estimates and there shall be no adjustment in the monetary consideration in the event the estimates are erroneous.

ARTICLE XIV - CHANGES

Notwithstanding Commission approval pursuant to subparagraph 1 of Article VI of final detailed specifications and fabrication drawings for RERR fuel assemblies, the Commission may issue written instructions requiring additional work or the omission of or variation in work covered by this Contract. If any such instruction issued subsequent to Commission approval of final specifications and fabrication drawings for RERR fuel assemblies results in a material change in the amount or character of the work required under the final specification an equitable financial adjustment shall be made in accordance with the agreement of the Parties and the Contract shall be modified accordingly. A failure to agree on an equitable adjustment under this Article shall be deemed a dispute within the meaning of Article XIX. Nothing contained in this Article shall excuse CNEN from proceeding with the prosecution of the work in accordance with the requirements of any instructions issued hereunder.

ARTICLE XV - LIABILITY TO OTHERS FOR DAMAGE TO PERSONS AND PROPERTY

The CNEN shall indemnify and hold harmless the Commission and any Contractor of the Commission with respect to any loss, expense, damage, demand, or claim arising out of or in connection with any injury or sickness or alleged injury or sickness (including death), to persons, or

damage or alleged damage to property sustained or alleged to have been sustained in connection with or to have arisen out of the performance of work hereunder by CNEN, its servants, contractors and employees (including the persons referred to in the first two sentences of Article IX, who shall be deemed to be under the technical supervision of CNEN) and shall to the extent consistent with law participate in the defense of any suit or claim against the Commission or its Contractors based on any such alleged injury, sickness or damage, and shall pay all damages, costs, and expenses, including attorney's fees, connected therewith or resulting therefrom.

ARTICLE XVI - PATENTS

A. Whenever any invention or discovery is made or conceived by CNEN, or its employees, or employees of its contractors, in the course of or under this Contract, CNEN shall furnish the Commission with complete information thereon.

B. As to any such invention or discovery:

1. The CNEN shall acquire all right, title and interest in and to any such invention, discovery, patent application or patent in Italy subject to a non-exclusive, irrevocable, royalty-free license in the United States of America with the right to grant sublicenses for all purposes; and
2. The Government of the United States of America shall be entitled to assignment of the title and rights in and to the invention, discovery, patent application or patent in the United States, and third countries subject to the

retention by CNEN of a non-exclusive, irrevocable, royalty-free license, with the right to grant sublicenses for all purposes.

C. No claim for pecuniary award or compensation under the provisions of the U.S. Atomic Energy Act of 1954, as from time to time amended, shall be asserted by CNEN, or its employees, or employees of its contractors, with respect to any such invention.

D. CNEN agrees to indemnify the U.S. Government, its officers, agents, servants and employees against liability of any kind (including costs and expenses incurred) for the use of any invention or discovery and for the infringement of any patent occurring in the performance of this Contract.

ARTICLE XVII - TERMINATION

A. If for any reason the Elk River reactor is shut down without reasonable expectation of its being operated further, or an excusable cause referred to in B below prevents the achievement of the objectives of this contract, or if for any reason the CNEN is unable to comply with the agreed schedule for delivery of RERR fuel assemblies, either the Commission or CNEN may terminate this Contract with respect to any remaining work hereunder by notice in writing to the other party. Should the PCUT plant not be operated or, if a further considerable delay is expected in its completion or operation, either the CNEN or the Commission may terminate this Contract.

B. Neither party shall be liable for any delay or for any failure to perform under this Contract which delay or failure is caused by any Act of God, strike, fire or the public enemy, accidental loss or destruction of the ERR or RERR fuel assemblies or any alternative form of recovered material, or other cause beyond the party's reasonable control in the light of the party's overall nuclear programs.

C. In the event this Contract is terminated, the Commission will notify the CNEN as to the form in which any theretofore delivered material is to be returned by CNEN and the payment, if any, due to the CNEN under Article XII of this Contract will be adjusted as provided in Article XIII.

ARTICLE XVIII - TERM OF CONTRACT

This Contract shall continue in full force and effect from the date hereof until completion of all work and services to be provided hereunder or until three years after delivery by the Commission of the first lot of ERR fuel assemblies, whichever first occurs, unless sooner terminated as provided herein or extended by mutual agreement.

ARTICLE XIX - DISPUTES

All disputes concerning questions of fact which may arise under this Contract, and which are not disposed of by mutual agreement, shall be referred to an arbitration board composed of three competent arbitrators. Such arbitrators shall be selected as follows: One arbitrator shall be appointed by the Commission, one shall be appointed by the CNEN, and the third shall be selected by the first two. In the event that the first two arbitrators so selected are unable to agree upon a third arbitrator, then

each of the Parties shall designate another person to act as an arbitrator in lieu of the person previously appointed by such Party, which new arbitrators shall endeavor to agree upon the third arbitrator. Such procedure shall be repeated until a third arbitrator shall have been selected. The decision of a majority of the arbitrators on the arbitration board shall be as determined by the board of arbitrators; provided, however, that neither party shall be obliged to pay the costs of the other party's arbitrator.

ARTICLE XX - ASSIGNMENT

CNEN shall not assign this Contract or any part thereof without the prior written consent of the Commission nor shall CNEN subcontract any part of the work and services without such consent.

ARTICLE XXI - OFFICIALS NOT TO BENEFIT

No member of or delegate to the United States Congress or resident commissioner shall be admitted to any share or part of this Contract or to any benefit that may arise therefrom.

ARTICLE XXII - COVENANT AGAINST CONTINGENT FEES

CNEN warrants that no person or selling agency has been employed or retained to solicit or secure this Contract upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the CNEN for the purpose of securing business. For breach or violation of this warranty, the United States

Government shall have the right to annul this Contract without liability or in its discretion to deduct from the Contract price or consideration or otherwise recover, the full amount of such commission, brokerage, or contingent fee.

ARTICLE XXIII - APPLICABLE LAW

This Contract shall be construed according to the laws applicable in the Federal Courts of the United States of America for contracts in the United States of America to which the Government of the United States of America is a party.

ARTICLE XXIV - NOTICES

Any notices, instructions or approvals between the parties to this Contract shall be forwarded to the CNEN under the following address:

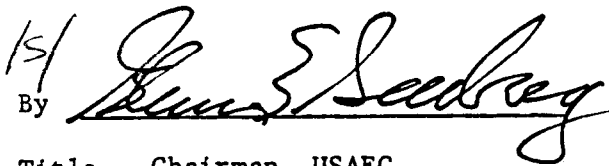
Director
PCUT Service
Comitato Nazionale per l'Energia Nucleare
15, Via Belisario
Rome, Italy

and to the Commission under the following address:

Director, Division of Reactor Development and Technology
U.S. Atomic Energy Commission
Washington, D.C. 20545

IN WITNESS WHEREOF the parties hereto have caused this Agreement
to be signed, intending to be legally bound thereby.

FOR THE UNITED STATES ATOMIC
ENERGY COMMISSION

/s/ 
By _____

Title Chairman, USAEC

Date November 17, 1965

FOR THE ITALIAN NATIONAL COMMITTEE
FOR NUCLEAR ENERGY

/s/ 
By _____

Title Vice President, CNEN

Date November 17, 1965

APPENDIX A

OUTLINE SPECIFICATION FOR ELK RIVER REACTOR FUEL ASSEMBLIES REMOTELY FABRICATED IN THE PCUT FACILITY (RERR)

I. SCOPE

This specification shall establish the outline requirements for acceptable Elk River Reactor (ERR) fuel element assemblies which shall be remotely fabricated in the Italian Progetto Ciclo Uranio-Torio (PCUT) facility from Core I ERR spent fuel assemblies.

II. FUNCTION

The function of the fuel assemblies is to produce thermal energy for the ERR plant. The fuel assemblies covered by the specification shall be made up of an array of fuel element rods consisting of pellets of $\text{ThO}_2\text{-UO}_2$ in metallic tubing and shall be suitable for utilization as a portion of or as a complete ERR core.

III. DEFINITIONS

To differentiate between the ERR Core I fuel assembly and the assemblies to be fabricated by CNEN under this specification, we will henceforth refer to the CNEN remotely fabricated Elk River fuel assembly as the RERR fuel assembly.

IV. DOCUMENTS

The following drawings are, by reference, a part of this specification:

- (a) Allis-Chalmers Drawing No. 41-501480 - "Fuel Element Assembly"
- (b) Drawing No. 41-501478 - "Fuel Element Details"
- (c) Drawing No. 41-501479 - "Fuel Element Details"

These drawings, while representative of the design of the fuel assemblies to be fabricated under this specification, do not necessarily represent the final design.

V. DESIGN CRITERIA

The RERR fuel assemblies shall be designed to satisfy the operating requirements of the ERR core. The basic design criteria are:

- Reactor Vessel Hydrostatic Test Pressure - 1375 psig
- Coolant - Boiling Light Water
- Coolant Pressure - 1165 psia, Maximum Normal Operating
- Bulk Coolant Temperature - 563°F, Maximum Normal Operating
- Heat Flux - 450,000 BTU/Hr-ft² Maximum
- No Fuel Melting
- Fuel - Thoria-Urania

The cladding thickness shall be sufficient to maintain corrosion resistance without impairing its leakproof integrity and to withstand fission gas release pressure for a fuel burnup of 14,000 MWD/1000 kg. of elemental thorium and uranium.

The basic RERR mechanical design shall be compatible with the ERR core dimensions and fuel handling equipment as specified by the Commission. Main features of ERR fuel assemblies may be taken as reference for application of above said design criteria for RERR fuel assembly.

The RERR mechanical design features shall provide for the elimination of all remote metallurgical fabrication operations except for the end plug weld at one end of each fuel rod. All mechanical subassemblies and materials except for the fuel rod shall be manufactured and inspected "cold" by methods similar to those employed in ERR Core I fuel assembly fabrication.

VI. DESCRIPTION OF RERR ELEMENT

With reference to the appended drawings, the RERR fuel element assembly shall consist of a square array of twenty-five (5 x 5) fuel rods held together at each end by a grid plate and end adaptor subassembly, and further supported at two intermediate positions by spacer grid subassemblies. The fuel rods shall be spaced on a 0.750 inch square pitch, each rod is 65 1/8 inches long and the complete assembly is 81 5/8 inches long over-all.

VII. MATERIALS OF CONSTRUCTION

With reference to the appended drawings, the materials of construction and applicable material specifications shall be:

<u>Number & Name of Item</u>	<u>Material</u>	<u>Specification</u>
6-Box fitting weldment	304 SS*	ASTM-A-167 GR 3
7-Adaptor	304 SS	ASTM-A-167 GR 3
8-Lower grid	304 SS	ASTM-A-351, GR CH 20
9-Upper grid	304 SS	ASTM-A-351, GR CH 20
10-Fuel grid clip	Inconel	
11-Fuel grid end bar	Inconel	
12-Fuel grid assembly	Inconel	
13-Lower end fitting	304L SS	ASTM-A-269-61
15-Spring	304 SS	ASTM-A-167 GR 3
16-Upper end fitting	304L SS	ASTM-A-269-61
17-Fuel pellet	Thoria-Urania	CNEN
18-Retaining Ring	304 SS	ASTM-A-167 GR e
19-Nose fitting	304 SS	ASTM-A-351, GR CH 20
20-Sleeve	304 SS	ASTM-A-167, GR 3
21-Transition fitting	304 SS	ASTM-A-351, GR CH 20
22-Square connector	304 SS	ASTM-A-167, GR 3
23-Tube pimpled	304L SS	ASTM-A-269-61
24-Upper end fitting-modified	304L SS	ASTM-A-269-61
25-Support fitting weldment	304 SS	(#19, 20, 21, and 22)

*Stainless steel

VIII. FUEL

The fuel for the RERR elements shall be made from the reconstituted recovered fuel material from the spent ERR Core I fuel. Throughout the chemical process samples shall be taken and analyzed as required so that the solution can be adjusted to achieve the required thorium to uranium ratio for the co-precipitation step. A sample of the finished pellets shall be analyzed for each batch processed. The number of pellets for each sample shall be approved by the Commission. The required thorium to uranium ratio shall be determined by the Commission, and specified prior to the time of fabrication.

The minimum density of any pellet used in an RERR fuel assembly shall be at least 93 per cent of the theoretical density of the thoria-urania mixture used.

The total area of chips shall not exceed 5 per cent of the cylindrical surface area of the pellet and any one chip shall not exceed 2 per cent of the pellet cylindrical surface area. The longitudinal cracks shall not exceed 25 per cent of the pellet length and any radial crack shall not exceed 50 per cent of the pellet diameter. Cracks of any measurable thickness shall be limited by the chip restrictions.

IX. INSPECTION AND TESTING

During the fabrication of the RERR fuel elements, all tests and inspections necessary to insure the compliance of fabrication with this specification shall be conducted by CNEN in the PCUT plant. The minimum inspection outlined below shall be performed to insure quality control:

Fuel Pellets

- (a) The fuel pellets shall be analyzed to determine that impurity (including fission products) limits specified by the Commission are not exceeded. This shall be done in accord with a sampling plan approved by the Commission.
- (b) A sample from each batch of pellets shall be analyzed for U/Th ratio and for uranium isotopic ratio.
- (c) Visual inspection of pellets shall be made using a comparative analysis with samples approved by the Commission. A set of standards approved by the Commission shall be used to facilitate visual inspection for cracks and chips in the fuel pellets.
- (d) The pellet dimensions and density shall be measured with an automatic inspection device; each pellet shall be inspected with this device; those pellets failing density inspection shall be recycled to the process; those pellets failing to meet the dimensional requirements may be ground to size. Undersized pellets shall be recycled to the process.

Fuel Tubing

The fuel element tubing shall be sealed in protective plastic wrapping after full testing and inspection in the manufacturer's plant.

- (a) Certified chemical analysis of samples, the number to be approved

by the Commission, from each lot of tubing shall be provided by the vendor to demonstrate that the composition and impurity requirements of ASTM A269-61 have been met. The lot size shall not exceed 1000 tubes of the finished length.

- (b) Metallographic examination specimens shall be prepared from tubes from each lot to determine that intergranular penetration is one thousandth of an inch or less when viewed at 100X. The number of specimens shall be approved by the Commission.
- (c) Each tube shall be visually inspected inside and outside with an illumination of at least 100 foot-candles of yellow-type fluorescent lighting. Discontinuities may be removed provided the tube wall thickness of each tube complies with the specified tolerances.
- (d) Each tube shall be subjected to an eddy current examination. The equipment and technique used shall be of sufficient sensitivity to detect, in any 0.15 square inch area, defects greater than 10 per cent of the wall thickness in the radial and circumferential direction, and 0.062 inch in the longitudinal direction. Tubes with defects in excess of these limits shall be rejected.
- (e) End Closure. The tubes shall be supplied with one end-plug welded in place and fully inspected. Thus the final step in the inspection of the tube shall be the inspection of the single end-plug weld.
- (f) Each tube shall be inspected to determine compliance with all dimensional requirements.
- (g) The tubing heat treatment, degree of cold work, minimum mechanical properties, etc., shall be approved by the Commission prior to tubing procurement.

Other Fuel Assembly Parts

The fuel assembly end grid castings, the intermediate spacer grids, the end plugs (for the second fuel rod closure), springs, and the snap rings required for attachment of the fuel pins to the end grid castings shall be supplied fully tested, and inspected, and packaged in the vendor's plant. The tests and inspection to be performed shall be approved by the Commission.

- (a) Certified chemical analysis of specimens from each component lot shall be provided to demonstrate that the composition and impurity specifications of the applicable ASTM specification have been met.

- (b) Ten per cent of each lot of the end grid castings shall be radiographed. Acceptance and rejection standards for castings shall be in accordance with the provisions of ASTM E-71, Class 3. Failure of any of the specimens in the ten per cent sample lot to meet the acceptance standards shall require that each grid casting in the lot be radiographed.
- (c) Each intermediate spacer grid shall be visually and mechanically inspected to Commission approved standards to insure the adequacy of the welds between the various straps and to insure that the surface finish of the fuel-tube openings is as specified. The diameter of each fuel tube opening shall be determined to be within the specified tolerance. The spacing of the tube opening in the grid shall be determined to be within the specified tolerance using a jig or fixture.
- (d) For purposes of RERR fuel assembly identification the upper end piece of each fuel assembly shall be marked by a method and in a manner to be specified by the Commission.

After final inspection and cleaning each of the components shall be sealed in a clear plastic bag for protection from foreign material contamination until just prior to assembly.

Fuel Assembly Fabrication

Fabrication of the fuel assembly from the fuel tubing, the other fuel assembly parts, and the fuel pellets shall be accomplished in the PCUT facility:

- (a) In the fabrication of the fuel rod subassembly, after the fuel pellets have been charged into the tube, the tube shall be evacuated to no more than 500 microns Hg pressure and back-filled with helium at atmospheric pressure. A second end plug shall be welded in place by shielded-arc automatic welding equipment. For each lot of 50 fuel rods welded, an empty rod shall be welded by the same process for destructive testing. This tube shall be sectioned at the welds and mounted for metallographic examination. Any evidence of a reduction in the tube wall thickness, porosity, poor weld penetration or micro-fissures when examined at a magnification of 250 X, shall be cause for rejection of the 50 rod lot. Acceptance and rejection standards shall be approved by the

Commission before production rods are produced.

- (b) All completed fuel rods shall be tested for helium leaks with a mass spectrometer leak detector. Each rod shall be placed in an evacuated chamber connected to a leak detector which is standardized every 8 hours with a calibrated standard that has a leak rate of 1.0×10^{-7} std. cc/sec. During the test the rods shall be maintained at a temperature of $550^{\circ} \pm 50^{\circ}\text{F}$ over their entire length. Any tube with a leak rate greater than 1.5×10^{-7} standard cc/sec. shall be rejected.
- (c) Surface contamination by fissionable or fertile material of the fuel rod tubing shall not exceed limits to be specified by the Commission.
- (d) Fabrication of the fuel element is completed with the assembly of the intermediate spacers, fuel pins, and end grid castings. No welding, or fasteners, shall be required for this operation. The assembly shall be held together by captive snap rings in the end grids.
- (e) After the assembly operation, the tube to tube spacing and the alignment of the "box fitting weldment" and the "support fitting weldment" shall be gaged to assure compliance with the specified tolerances.
- (f) After a final visual inspection the completed assembly shall be packaged and prepared for shipment in a Commission furnished cask to a specified port of import in the United States.